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XX. Some observations on the effects of dividing the nerves of the lungs, and subjecting the latter to the influence of voltaic electricity. By A. P. W. PHILIP, M. D. F R. S. L. and E.

Read May 10, 1827.

THE Royal Society did me the honour in 1822 to publish the results of some experiments, from which it appeared that the secreted fluids of animals are so deranged by dividing the nerves of the secreting organs, and separating the divided ends, that they are no longer capable of their functions ; and that after these functions are thus destroyed, they may be restored by transmitting voltaic electricity through the secreting organs by the portions of the divided nerves attached to them.

In the statement of these results, the attention was chiefly directed to the function of the stomach. In the present communication I shall make a few additional observations respecting the lungs.

However much the secreting surface of the stomach may be deranged by the means just mentioned, its appearance, owing we have reason to believe to the extreme minuteness of its structure, is the same as when the nerves have been left undisturbed, or nearly so, and with the exception of occasional efforts to vomit, no symptom shows itself after the division of the nerves indicating the derangement of function which has taken place. Both in the symptoms and appearances after death, the derangement occasioned in the lungs by their division is much more remarkable.

Soon after the operation the animal begins to breathe with difficulty, and this symptom gradually increases, and is at

length evidently the cause of death. On inspecting the lungs after death, the air tubes and cells, as far as they can still be traced, are found filled with a viscid fluid ; and in a considerable proportion of the lungs, generally more or less according to the time the animal has survived the operation, every trace of both tubes and cells is obliterated, the lungs both in colour and consistence assuming much of the appearance of the liver. The portions of lungs thus changed sink in water ; and although examined with the greatest care, and the aid of a powerful magnifying glass, both by Mr. CUTLER, who was so kind as to give me his assistance, and myself, we could not perceive in them the least remains of the structure peculiar to this viscus.

I wished however to ascertain, by means less fallacious than the sight, whether the structure of the lungs in the parts most effected, be really so changed as to cause the obliteration of their cavities. Mr. CUTLER, at my request, was so obliging as to make the following experiments, the account of which I shall give in his own words.

“ If you cut out a portion of each of the eighth pair of
“ nerves in the neck of a rabbit, it seldom dies within eight
“ hours, and rarely survives more than twenty-four hours.

“ On examination after death, the lungs are found, in
“ many parts, covered with dark red patches.

“ To ascertain the mischief done to the substance of the
“ lungs, I endeavoured to fill them with mercury by the
“ trachea, but from the delicate structure of the air cells a
“ rupture took place, and the mercury escaped.

“ I then endeavoured to inject the air cells through the
“ trachea with the finest vermillion injection. In the healthy

“ lungs the attempt was invariably successful, making the “ whole of a bright scarlet colour, and, on cutting into them, “ every part was found to be uniformly filled with the in-“ jection.

“ After injecting the diseased lungs, the dark red patches “ remained on their surface: other parts of the lungs were “ of a bright red colour: some parts were partially injected, “ and other parts retained their natural appearance.

“ This was explained on dissection. Those parts of the “ lungs which were completely injected had not suffered from “ disease, other parts had suffered sufficiently partially to “ obstruct the injection, while some parts were so completely “ hepatised that not a particle of injection could enter them, or “ the parts beyond them, which were not equally diseased.

“ Those portions of the lungs which were completely “ injected, sunk in water, from the weight of the injection.

“ The hepatised portions, from their diseased state, sunk “ also, whilst the portions beyond them, having their natural “ appearance, floated.”

If, as I have repeatedly ascertained, and various gentlemen have witnessed, after the nerves are divided, and the divided ends separated, the due degree of voltaic electricity be transmitted through the lungs, by those portions of the nerves which remain attached to them, no affection of the breathing supervenes, and the lungs, after death, are found quite healthy, unless the electricity has been applied of such power, or continued for such a length of time, as to excite inflammation, and *then the appearances on dissection are those of inflammation, not those produced by the division of the nerves of the lungs.*

It appears from these facts, that the effect of dividing the nerves of a vital organ, and separating the divided ends, is not merely that of deranging its secreting power, but *all those powers on which its healthy structure depends*; and that the effect of voltaic electricity, is that of *preserving all these powers*. It is particularly to be observed, that the voltaic apparatus should be so arranged that its influence may be transmitted through the lungs as soon as the nerves are divided, the delay of even a short time appearing to give rise to more or less morbid appearance in the lungs.

The present Paper may be considered as the concluding part of an inquiry in which I have been engaged for many years; two papers relating to which the Royal Society did me the honour to publish in the Philosophical Transactions for 1817 and 1822.* To the first of these papers I have already had occasion to refer; the other was entitled, “On the effects of Galvanism in restoring the due action of the lungs.” The objects of this inquiry were to ascertain how far the nervous power is essential to the function of secretion, and the other assimilating processes of the animal body; and whether the voltaic electricity, applied as far as possible, in the same way in which the nervous power is applied, is capable of supplying its place in these processes. It appears from the various experiments, the results of which have now been laid before the Society, that the answer in both instances is in the affirmative.

* The contents of these Papers have, with the consent of the President and Council of the Royal Society, been re-published more in detail, in the third edition of my Inquiry into the Laws of the Vital Functions.